2.0 General Description of the Study Corridors

In recent years, Washington County has experienced rapid growth and changes in the locations where people are living in the county. Overall, recent county growth has mostly been a result of migration from other areas of the state and from outside Utah. Although the county has a reputation for attracting people from outside Utah, data show that most recent (2004 through 2006) "moves" in Washington County were a result of existing county residents moving within the county. Between 2004 and 2006, 53% of moves in the county were existing residents relocating within the county. During this same period, in-migration from outside of Utah accounted for about 25% of all moves, and migration from other counties in Utah made up about 23% of all moves (U.S. Census Bureau 2005, 2006). Many of the inter-county moves were residents moving from larger communities, such as St. George, to developing areas or communities that have traditionally been much smaller, such as Hurricane.

Washington County will probably continue to grow more quickly than most other counties in Utah due to its location, amenities, and weather. Local and state governments recognize that growth will lead to new and expanded pressures on resources and infrastructure. These governments recently began collaborative long-range planning to create a blueprint for the county's future. The most notable recent effort is the Vision Dixie process, which was completed in 2007.

UDOT selected three rural highways in eastern Washington County for study because of recent and expected growth along the highways and because of the highways' proximity and connections to other parts of this growing region. Through the EWCTS, UDOT hopes to continue the regional planning emphasis by reviewing existing and future needs in eastern Washington County.

This section reviews the existing environmental and road conditions along the study corridors. The study corridors pass through several small cities and towns, including Hurricane (SR-9 and SR-59), La Verkin (SR-9 and SR-17), Virgin (SR-9), Rockville (SR-9), Springdale (SR-9), Toquerville (SR-17), Hildale (SR-59), and Apple Valley (SR-59). Some of these communities, such as Hurricane and Apple Valley, anticipate extensive growth during the EWCTS planning period (through 2035). Others, such as Rockville, expect growth to be slow.

2.1 Environmental Setting

The EWCTS area is located in an area known as the Dixie Basin. The Dixie Basin is situated in a transition zone where the Basin and Range and the

Colorado Plateau physiographic provinces meet. The study area includes scenic rock formations (such as cliffs and mesas), the Virgin River, and wide expanses of colorful desert landscape. Zion National Park, probably the most well-known landmark in the area, lies on the eastern edge of the study area.

The following sections summarize land use and the natural environments along the corridors.

2.1.1 General Conditions Common to All Corridors

Cultural Resources

The EWCTS did not include detailed records searches or surveys for cultural resources. Instead, this report describes the cultural resource environment using an approach that was successfully used for the *Southern Corridor Draft Environmental Impact Statement and Section 4(f) Evaluation* (UDOT and FHWA 2003).

Because the number and location of historic and archaeological sites and the presence of paleontological resources are unknown, it is difficult to anticipate how such sites and resources could be affected by road improvement projects along SR-9, SR-17, and SR-59. To provide an estimate of potential sites, an average number of archaeological sites per acre was developed based on the intensive-level pedestrian (walking) survey conducted for the Southern Corridor project. That survey, which studied about 4,000 acres, found that the average site density is 0.032 sites per acre (this includes National Register–eligible and non-eligible sites). Table 2-1 shows the expected number of sites that are likely present along each highway segment.

Table 2-1. Expected Archaeological Resource Sites along the Study Highway Segments

Highway	Length of Study Segment (miles)	Potential Area of Impact (acres)[a]	Expected Number of Sites in Potential Area of Impact[b]
SR-9	22	3,520	113 sites
SR-17	6	960	31 sites
SR-59	22	3,520	113 sites

[a] The potential area of impact assumes that modifications would be made to the mainline highway only and would be completed within a one-quarter-mile "strip" with the highway as the centerline.

[b] Density of 0.032 sites per acre multiplied by the number of acres potentially affected.

The site density method focuses on archaeological sites only. A number of properties are listed on the National Register of Historic Places in this part of Washington County (especially in Zion National Park), but a complete survey for properties that are eligible but not listed would need to be completed in support of any construction project. Given the historic nature of towns along the highways, it is likely that eligible historic structures are present in these towns. Other potentially historic features, such as farmsteads and historic travel routes, are probably also present along the highways. These types of cultural resources would also be considered according to Section 4(f) of the U.S. Department of Transportation Act of 1966.

Finally, southern Utah is rich in paleontological resources, and it is likely that paleontological resources are present along segments of all study highways.

Special-Status Soils

The Natural Resources Conservation Service (NRCS) identifies soils that can support prime farmland. Because soil types are generally not specific to any one area along the study highways, this study considers the distribution of prime farmland soils.

NRCS makes determinations regarding the applicability of the Farmland Protection Policy Act (FPPA) and the conversion of prime farmland, unique farmland, and farmland of statewide or local importance. According to the text of the act, the FPPA generally does not apply to land that is already committed to urban development or that supports densities of at least 1.3 structures per acre. Some of the areas that support prime farmland soils along the study corridors are within incorporated areas that are already developed. It is unlikely that NRCS would seek to apply the FPPA in these areas.

Hydric soils can provide clues about the potential presence of wetlands, so hydric soils are also considered special-status soils.

Table 2-2 below summarizes the distribution of special-status soils along the study corridors. Special-status agricultural soils that are within developed areas (and thus exempt from the FPPA) are included in the table and are noted as such.

Table 2-2. Special-Status Soils along the Study Highway Segments

Soil Name	Status	General Locations
Clovis fine sandy loam, 1% to 5% slopes	Prime farmland if irrigated	• One of the dominant soil types between about Milepost (MP) 8 and MP 12 on SR-59 (much of this is within the incorporated town of Apple Valley) • Minor occurrences along SR-17 where Ash Creek and La Verkin Creek cross the road (incorporated areas of Toquerville and La Verkin) and on SR-9 at about MP 18 and MP 25
Fluvaquents and torrifluvents, sandy	Hydric	• One of the dominant soil types between about MP 18 and MP 31 on SR-9 (some in incorporated areas) • Minor occurrences at about MP 1 on SR-17 (incorporated area of Toquerville) and MP 9–10 on SR-59
Harrisburg fine sandy loam, 1% to 5% slopes	Prime farmland if irrigated	• Isolated occurrence at about MP 10 on SR-9 in Hurricane (incorporated area)
Laverkin fine sandy loam, 2% to 5% slopes	Prime farmland if irrigated	• Limited distribution along SR-17 at about MP 1 (incorporated area of La Verkin)
Laverkin silty clay loam, 1% to 2% slopes	Prime farmland if irrigated	• Concentrated at confluence of Virgin River and La Verkin Creek at about MP 12 on SR-9 (incorporated area of La Verkin)
Leeds silty clay loam, 0% to 1% slopes	Prime farmland if irrigated	• Concentrated at confluence of Virgin River and La Verkin Creek at about MP 12 on SR-9 (incorporated area of La Verkin)
Leeds silty clay loam, 1% to 2% slopes	Prime farmland if irrigated	• Concentrated near the intersection of SR-9 and SR-59 in Hurricane (incorporated area of Hurricane)
Leeds silty clay loam, 5% to 10% slopes	Prime farmland if irrigated	• Concentration between MP 12 and MP 13 on SR-9 (incorporated area of La Verkin) • Minor occurrences at about MP 10 along SR-9 (incorporated area of Hurricane)
Naplene silt loam, 2% to 6% slopes	Prime farmland if irrigated	• Concentrated along SR-9 between MP 30 and MP 33 (incorporated area of Springdale) • Pockets along other areas of SR-9 at about MP 19 and MP 28
Palma fine sandy loam, 1% to 5% slopes	Farmland of statewide importance	• One of the dominant soil types between about MP 6 and MP 8 on SR-59; spot occurrences at about MP 18 on SR-59 and MP 18 on SR-9
Redbank fine sandy loam, 1% to 5% slopes	Prime farmland if irrigated	• Concentrations along SR-59 at about MP 2, MP 4–5, MP 8, and MP 11 through MP 15 • Pockets at about MP 19 on SR-9 and MP 6 on SR-17 (incorporated area of Toquerville)
Redbank silty clay loam, 0% to 2% slopes	Prime farmland if irrigated	• One of the dominant soil types between about MP 18 and MP 30 on SR-9 (some in incorporated areas)
Riverwash	Hydric	• Along SR-17 between MP 3 and MP 4 (incorporated area of Toquerville)
Tobler fine sandy loam	Prime farmland if irrigated	• Pockets along SR-17 between MP 0 and MP 2 (incorporated area of La Verkin)
Tobler silty clay loam	Prime farmland if irrigated	• Pockets along SR-17 at about MP 1 (incorporated area of La Verkin) and MP 4 (incorporated area of Toquerville)

Source: Natural Resources Conservation Service 2007

Wildlife Connectivity

UDOT's report titled *Wildlife Connectivity Across Utah's Highways – Updated* (UDOT 2007a) does not identify any of the segments of SR-9, SR-17, or SR-59 that are being evaluated as part of this study as having critical, high, or moderate importance to wildlife connectivity for any species (fish, mammals, amphibians, reptiles, or birds).

2.1.2 Conditions and Resources along SR-9

In the study area, SR-9 travels through the developed cities of Hurricane and La Verkin and through the small towns of Virgin, Rockville, and Springdale. Most of the 22-mile-long segment travels through undeveloped and scenic land under private ownership and land that is administered by the Bureau of Land Management and the Utah School and Institutional Trust Lands Administration (SITLA; see Table 2-3 and Figure 2 below). The highway generally follows the Virgin River and leads to the western entrance to Zion National Park.

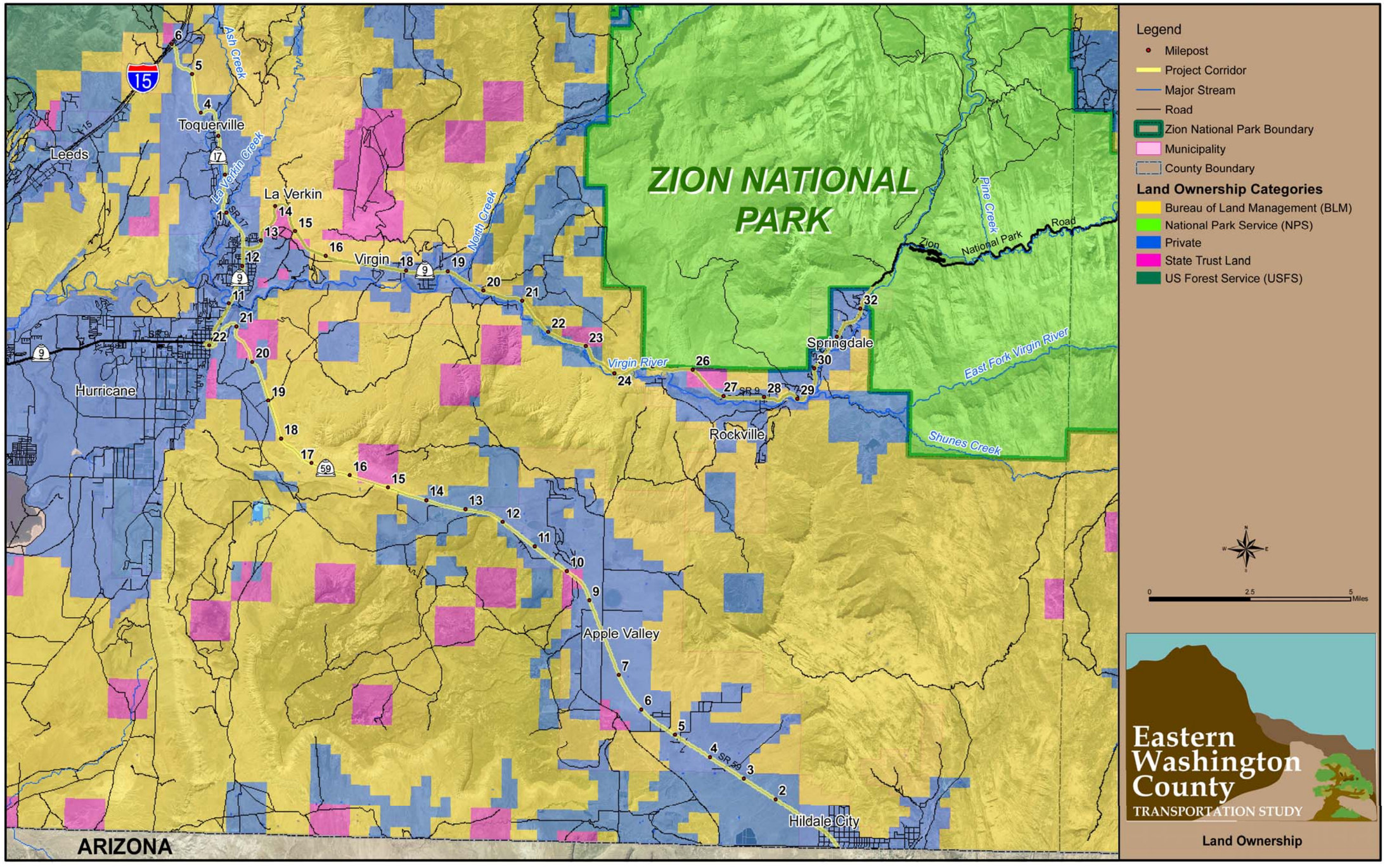
Table 2-3. Land Ownership along SR-9

Owner		Land Owned within 500 Feet of Highway Centerline[a]
Federal government		26.4%
Bureau of Land Management (BLM)	23.7%	
National Park Service	2.7%	
State of Utah		
School and Institutional Trust Lands Administration (SITLA)		9.4%
Private		64.2%
Total		**100.0%**

Source: AGRC 2008

[a] Does not include UDOT-owned right-of-way.

Figure 2. Land Ownership



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Land Use

The segment of SR-9 that is being evaluated as part of this corridor study begins at about MP 10 in Hurricane. The specific land uses along the corridor vary depending on the level of development. The highway travels north through a light industrial/commercial area on the north end of Hurricane. Land use transitions to residential and some commercial development as the highway enters La Verkin. Past the intersection of SR-9 and SR-17, land uses along SR-9 quickly transition to sparsely developed and then undeveloped land as the highway travels east. The La Verkin land-use plan (City of La Verkin, no date) shows commercial uses surrounding the intersection of SR-9 and SR-17 with a transition to residential uses south of SR-9 and recreational uses north of SR-9 as the highway travels east and to the "top side," or western part, of the city. Much of the top side is designated for future planned community development (City of La Verkin, no date).

As SR-9 exits La Verkin, the land remains mostly undeveloped until SR-9 approaches the town of Virgin at about MP 18. This historic community is characterized by sparse, older, low-density residential development. The Zion River Resort RV (Recreational Vehicle) Park is at the eastern end of town.

East of Virgin, SR-9 travels past rural residential development and agricultural land along the Virgin River (which is south of the highway) and undeveloped areas both along both sides. SR-9 enters the town of Rockville, the least-populous municipality along any of the study corridors, at about MP 27. Rockville is primarily a small, residential community that does not have a developed commercial core. Outside the town center, Rockville's established residential areas primarily support large-lot, single-family residences. The patterns and amount of growth anticipated for Rockville are not expected to change or increase substantially during the EWCTS planning period (HDR 2008).

Rural residential development continues as SR-9 leaves Rockville and travels toward Springdale. Located at the entrance to Zion National Park, Springdale caters to tourists and has many modern motels, inns, and small businesses. Springdale is a small city, and development is focused along the highway. There are older residential developments alongside newer developments. The Springdale zoning map (Town of Springdale 2007) shows commercial uses clustered along the highway with some higher-density residential uses.

Geology and Soils

This section of SR-9 runs east-west along the north side of the Virgin River. The geology of this section is characterized by Hurricane Mesa, Kolob Plateau, and the mountains of Zion National Park to the north and by the Gooseberry Mesa and Canaan Mountain to the south. Zion National Park, which surrounds the eastern end of this segment, includes very large erosional forms in white Jurassic cliffs that were carved by the Virgin River (Hintze 1974; Stokes 1986; UGS 2004).

The landslide susceptibility map for Utah (Giraud and Shaw 2007) shows areas of low to moderate susceptibility in the vicinity of La Verkin and at other isolated points all the way to the east end of the SR-9 study area in Springdale. There are some areas of high susceptibility (existing shallow and deep landslides) south of SR-9 near Springdale, but these areas are not immediately adjacent to the highway.

This section of highway runs through soils that are identified as prime farmland if irrigated. Some of these areas, such as those along the highway in Springdale, might not be subject to the provisions of the FPPA because of the level of development.

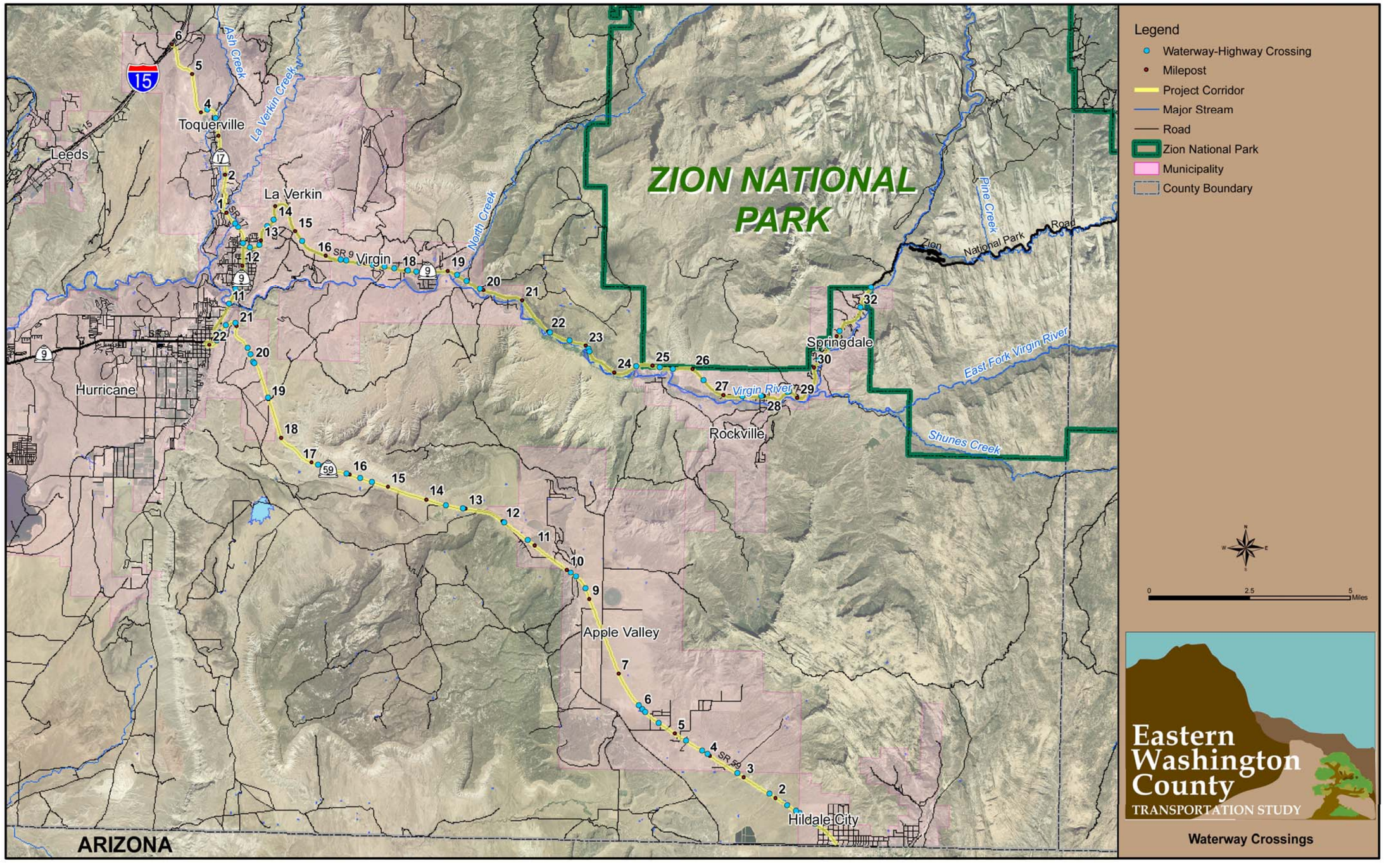
Water Resources

The highway crosses the Virgin River at about MP 11 on the north end of Hurricane. After its intersection with SR-17, SR-9 parallels the Virgin River to the end of the study segment at about MP 33. The East Fork of the Virgin River flows into the main fork at about MP 29.

SR-9 crosses more than 30 washes and creeks along this segment, many of which are unnamed (see Figure 3 below). The road crosses floodplains of the Virgin River that have been mapped by the Federal Emergency Management Agency (FEMA) at about MP 18.3, a feature called The Wash at about MP 18.6, North Creek at about MP 19.2, unnamed tributaries to the Virgin River at about MP 21 and MP 31, and Blacks Canyon at about MP 32. Two water bodies along this section of SR-9 are identified as impaired under Section 303(d) of the federal Clean Water Act: North Creek (and its tributaries) from its confluence with the Virgin River to its headwaters and the Virgin River at the Springdale Wastewater Treatment Facility (EPA 2008).

A natural resources “windshield” (drive-through) survey completed for the EWCTS (HDR 2007) found that limited wetland areas are common in the floodplains associated with North Creek, the Virgin River, and the East Fork of the Virgin River.

Figure 3. Waterway Crossings



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Fish and Wildlife Resources

Because of the highway's proximity to the Virgin River, the 2003–2005 wildlife strike data for this stretch of SR-9 show a concentration of vehicle-animal strikes, although the total number of recorded strikes is still not substantial (a total of about 10 strikes over the 2-year period).[1] The locations of the recorded wildlife strikes are in areas that appear to be most suitable for deer and elk migration, which are along the Virgin River in the narrow canyon through Virgin and in the town of Springdale.

The windshield survey found that the entire length of SR-9 has nesting and foraging cliff habitat[2] for raptors (see Figure 4 below). The survey report specifically mentions habitat for Mexican spotted owl, peregrine falcon, and California condor around MP 32. Other special-status species that are or might be present along this section of SR-9 include desert tortoise in and around the city of Springdale, several fish that occur only in the Virgin River, southwestern willow flycatcher in riparian areas along the Virgin River, and Arizona toad. Bats could use the bridge over the Virgin River at MP 11 for roosting.

Habitat for sensitive plant species is present on gypsiferous, unstable clay soils derived from the Chinle and Moenkopi formations. The windshield survey found that these soils are present along SR-9 between about MP 25.5 and MP 27. These soils appear as white foothills on the north side of the highway.

Section 4(f) and Section 6(f) Resources

Section 4(f) of the Department of Transportation Act applies to "publicly owned land of a public park, recreation area, or wildlife and waterfowl refuge of national, state, or local significance, or land of an historic site of national, state, or local significance."

A number of publicly owned recreation areas would be subject to the conditions of Section 4(f) if they are affected by the construction of a federally funded project. These recreation areas include a baseball field/park in La Verkin at about MP 11.8, a Zion National Park trailhead (Coalpits Wash) at about MP 25.3, a park in Springdale at about MP 30, and the Zion National Park entrance station and facilities at the corridor terminus at about MP 33.5.

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[1] These data account only for recorded or reported wildlife strikes. While the actual number of strikes might be higher than reported, the locations of recorded strikes can indicate areas where wildlife crossings could cause conflict.

[2] The term *habitat* in this report means habitat that is suitable for a particular species but that does not necessarily have current populations of that species.

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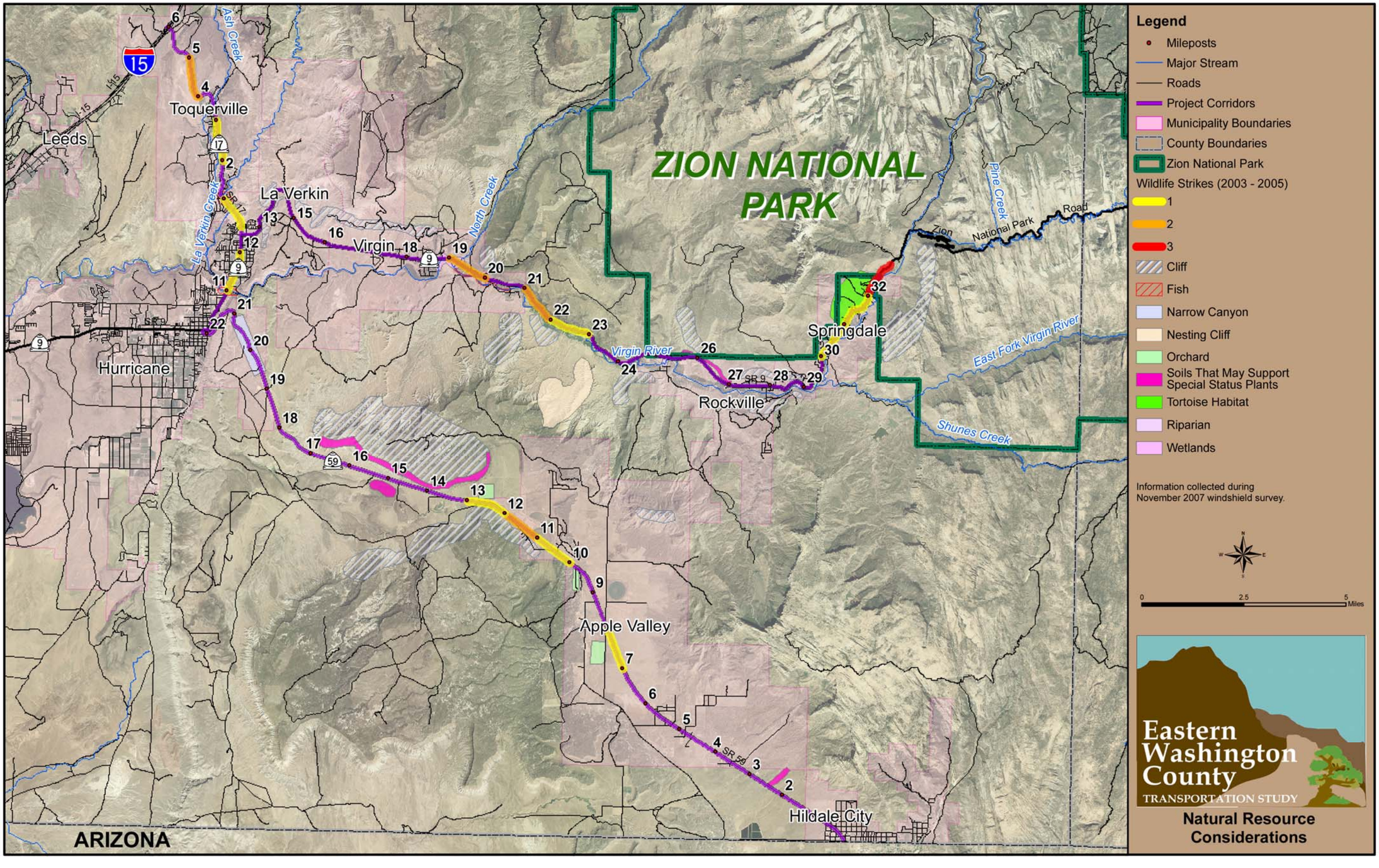
Figure 4. Natural Resource Considerations



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There are also a number of properties listed on the National Register of Historic Places near the eastern end of the study segment in Zion National Park. One of these properties, the South Entrance Station, is situated at the terminus of the study segment; other properties are outside the study limits. The Deseret Telegraph and Post Office property, which is in Rockville, is also included on the National Register. Other listed properties, including the Rockville Bridge in Rockville and the James Jepson House in Virgin, are probably far enough from the highway that any construction along SR-9 would not affect these resources. There are also several historic buildings in all of the communities along SR-9 that might be eligible for listing on the National Register and therefore subject to regulation under Section 4(f).

State and local governments often obtain grants to acquire or make improvements to parks and recreation areas through the federal Land and Water Conservation Fund Act of 1965 (16 United States Code [U.S.C.] Sections 4601-4 through 4601-11, September 3, 1964, as amended). Section 6(f) of this act prohibits the conversion of property acquired or developed with these grants to a non-recreational use without the approval of the U.S. Department of the Interior's National Park Service. Section 6(f) directs the Department of the Interior to ensure that replacement lands of equal (monetary) value, location, and usefulness are provided as conditions to such conversions. There are no Section 6(f) resources along SR-9 (National Park Service 2008).

2.1.3 Conditions and Resources along SR-17

SR-17 is the shortest highway segment studied as part of the EWCTS. The segment begins at the intersection of SR-17 and SR-9 in La Verkin and travels north for about 6 miles through Toquerville to Anderson Junction at I-15. All land along SR-17 is within the incorporated areas of La Verkin and Toquerville, although some land along the corridor is under federal and state ownership (see Table 2-4 below and Figure 2 above, Land Ownership).

Table 2-4. Land Ownership along SR-17

Owner	Land Owned within 500 Feet of Highway Centerline[a]
Federal government	
BLM	6.5%
State of Utah	
SITLA	1.3%
Private	92.2%
Total	**100.0%**

Source: AGRC 2008

[a] Does not include UDOT-owned right-of-way.

Land Use

SR-17 passes through developed areas associated with the cities of La Verkin and Toquerville (MP 0 through about MP 4), with some large-lot residential development between the two cities. Between the Ash Creek crossing (at about MP 3.5 on the north end of Toquerville) and I-15, the land is mostly undeveloped. Commercial and residential uses have direct access to the highway along its length. Some new residential developments are anticipated along the this segment between about MP 1 and MP 4. These developments would mostly be extensions of other recently developed areas on the edges of the two cities. Given the current access configuration, these new developments would probably also have primary accesses from SR-17.

The City of La Verkin land-use map (City of La Verkin, no date) designates the land between MP 0 and about MP 1 as suitable for future commercial and residential land uses. There are small areas of agricultural and industrial land in this area as well.

There is little commercially zoned land in Toquerville. The Toquerville zoning map (Toquerville City 2006) shows neighborhood commercial uses at the south end of town along SR-17 and highway commercial on the north end of town where SR-17 intersects I-15. Land along the west side of SR-17 though the center of Toquerville is designated for single-family residential uses, while land along the east side is designated for agricultural uses. Undeveloped land along SR-17 north of downtown and south of I-15 is designated for multiple uses. Recent aerial photographs of the corridor show a development pattern that is consistent with these existing zoning and land-use designations.

Geology and Soils

SR-17 runs north-south along the Hurricane Fault. This active fault trends north-south through Washington County and extends from Cedar City on the north to south of the Grand Canyon on the south (FCAOG 2008). This section of SR-17 runs along the alignment of the Hurricane Cliffs along a low-elevation break in the cliffs. The plateaus east of the Hurricane Cliffs move up (north) along the Hurricane fault zone relative to the downward (south) movement of the cities of La Verkin and Hurricane on the west side of the fault zone. The area is bounded by the Pine Valley Mountains to the west and the Smith Mesa to the east (Hintze 1974; Stokes 1986; UGS 2004).

The landslide susceptibility map for Utah (Giraud and Shaw 2007) shows areas of moderate susceptibility (areas with slopes that are prone to landsliding based on observed landslide slope angles) along the east side of SR-17 between MP 0 and about MP 4. The remainder of the corridor is generally of very low susceptibility (areas unlikely to produce landslides) or low susceptibility (areas with slopes that could produce landslides).

This section of highway runs through soils that are identified as prime farmland if irrigated, but much of this area is probably exempt from the provisions of the FPPA.

Water Resources

SR-17 crosses two named creeks, La Verkin Creek at about MP 0.5 and Ash Creek at about MP 3.5, and an unnamed wash at about MP 3.8. These creeks are typical of desert streams and primarily flow in response to storms, though there might be some intermittent flow between storms. FEMA has mapped the 100-year floodplains associated with La Verkin Creek and Ash Creek; the road crosses the mapped floodplain of Ash Creek on the north end of Toquerville and the mapped floodplain of La Verkin Creek on the south end of Toquerville. La Verkin Creek and Ash Creek are within the Virgin River watershed, parts of which are identified as impaired by pollutants under Section 303(d) of the federal Clean Water Act. La Verkin Creek and Ash Creek, however, are outside (upstream) of the areas of the watershed that are identified as impaired (EPA 2008).

The natural resources windshield survey report for SR-17 mentioned the highway's proximity to La Verkin Creek and Ash Creek and stated that both creeks have associated riparian zones and wetlands near the highway.

Fish and Wildlife Resources

The windshield survey found that La Verkin Creek and Ash Creek provide suitable habitat for several fish species that occur only in the Virgin River system and that the associated riparian areas provide habitat for the federally endangered southwestern willow flycatcher. Wildlife regularly cross SR-17 near these riparian areas and near irrigated fields in the agricultural areas of the corridor. Bats could use the bridges over La Verkin Creek and Ash Creek and the cliffs east of SR-17 for roosting.

Section 4(f) and Section 6(f) Resources

Two properties are listed on the National Register of Historic Places along SR-17: the Naegle Winery along SR-17 in downtown Toquerville and the John Steele House along SR-17 on the north end of Toquerville. Given Toquerville's history, it is likely that there are additional buildings and associated land along SR-17 that are eligible for listing on the National Register and therefore would be considered Section 4(f) resources. The City of La Verkin is planning to construct a recreational trail along La Verkin Creek that would come very close to SR-17 at about MP 0.5. There are no other potential 4(f) resources along SR-17.

There are no Section 6(f) resources along SR-17 (National Park Service 2008).

2.1.4 Conditions and Resources along SR-59

The entire length of SR-59 is in the study area. SR-59 begins at the Arizona-Utah border and ends at its intersection with SR-9 in Hurricane. About half of the land next to the highway is in the incorporated areas of Hildale (MP 0 to MP 1.5), Apple Valley (MP 3 to MP 13), and Hurricane (MP 18 to MP 22). As shown in Table 2-5 below and Figure 2 above, Land Ownership, most of the land along SR-59 is privately owned.

Table 2-5. Land Ownership along SR-59

Owner	Land Owned within 500 Feet of Highway Centerline[a,b]
Federal government	
BLM	18.6%
State of Utah	
SITLA	7.7%
Private	73.6%
Total	**99.9%**

Source: AGRC 2008

[a] Percentages do not add up to 100% due to rounding.

[b] Does not include UDOT-owned right-of-way.

Land Use

Hildale is a small town that is characterized by denser residential development in the city center. Development in Hildale and neighboring Colorado City, Arizona, generally runs together, and the area functions like a single city. SR-59 passes through the western edge of Hildale and has very little development along the corridor on the Utah side.

Currently, there are about 750 residents and 425 homes in Apple Valley (HDR 2008). A review of the Apple Valley land-use plan shows that the town expects substantial residential and commercial growth in the EWCTS planning period. Discussions with town representatives confirmed the expected growth. According to the city, several new residential subdivision developments are in the planning and engineering stages, and the town expects construction of an additional 700 to 800 homes by 2010. Other major developments expected in the next 5 years include completion of a major golf resort (currently under construction), construction of a film production facility, and construction of at least one large hotel (HDR 2008).

Accesses to two major BLM recreation areas are within the incorporated area of Apple Valley: the road to Little Creek Mesa at about MP 8.7 and the road to Gooseberry Mesa at about MP 8. These uses are not on SR-59, but maintaining the highway accesses to these important recreation areas is critical.

SR-59 approaches the Hurricane incorporated area at about MP 19. Land along this stretch of SR-59 is generally undeveloped, though there are some scattered residential estates on the cliffs above town at about MP 21. The highway intersects SR-9 on the eastern edge of the city's primary development area.

Geology and Soils

SR-59 runs northwest to southeast along a mid-elevation landform that is bounded by the Gooseberry Mesa and Vermillion Cliffs to the northeast and Little Creek Mountain and Lost Spring Mountain to the southwest. The primary geological composition of this section is Triassic rock, with Quaternary-Tertiary basalt to the southwest at the western half of this section and Quaternary rock to the northeast at the eastern half of this section (Hintze 1974; Stokes 1986; UGS 2004).

Most of the SR-59 corridor is mapped as having a very low probability for landslides (Giraud and Shaw 2007). There are areas of moderate susceptibility near the cliffs between about MP 13 and MP 17 and areas of high susceptibility east of the highway at about MP 6.

A substantial part of SR-59 runs through soils that both support farmland of statewide importance and can support prime farmland if irrigated. Even though much of the corridor runs through the incorporated area of Apple Valley, this city is sparsely developed, and agricultural soils in the incorporated areas could be subject to the provisions of the FPPA.

Water Resources

SR-59 crosses 30 creeks, washes, and drainage ditches, most of which are unnamed. SR-59 does not cross any regulatory floodplains identified by FEMA or any waters that are identified as impaired under Section 303(d) of the Clean Water Act (EPA 2008).

The windshield survey found that there are potential wetland areas between about MP 9 and MP 12 in Apple Valley and in the canyon approaching Hurricane between about MP 19 and MP 21.

Fish and Wildlife Resources

The 2003–2005 wildlife strike data for SR-59 show some incidents in the northern part of Apple Valley, though the numbers are not high (a total of five strikes recorded over the 2-year sampling period). A higher incidence of vehicle-wildlife incidents would be expected here given the presence of food and water (irrigation) associated with agriculture in the valley.

The windshield survey found that there is cliff habitat suitable for nesting raptors between about MP 9 and MP 19 (see Figure 4 above, Natural Resource Considerations). The creeks and other drainages along SR-59 do not provide

suitable habitat for any of the sensitive fish species that occur only in the Virgin River and its tributaries.

Suitable habitat (that is, soils) for sensitive plant species is present along SR-59 between about MP 13 and MP 17 (on the gray foothills on the north side) and at about MP 2.5 (on the purple outcropping north of the highway).

Section 4(f) and Section 6(f) Resources

There are no publicly owned parks along SR-59. The National Register of Historic Places includes two properties in Hurricane that are near the intersection of SR-59 and SR-9: the Hurricane Historic District and the Bradshaw House at 85 S. Main Street.

There are no Section 6(f) resources along SR-59 (National Park Service 2008).

2.1.5 Population and Employment

Population

In March 2008, the U.S. Census Bureau released its most recent population estimates for counties in Utah. According to the Bureau, Washington County is the nation's fifth-fastest-growing county. Washington County's population grew by about 30% between 2000 and 2007. Table 2-6 summarizes the recent population growth and current estimate. As shown in the table, 2005 and 2006 were a substantial growth period for the county (nearly 40% of the 7-year growth occurred during these 2 years). Washington County's growth rate was at least or more than double that of the state during each of the 7 years shown in the table, except for 2001.

Table 2-6. Recent Population Growth in Washington County (2000–2007)

Parameter	Estimate by Year[a]								2000–2007 Change
	2000	2001	2002	2003	2004	2005	2006	2007	
Washington County population	91,259	94,636	99,467	104,324	110,372	119,224	127,310	133,791	42,532
Washington County annual growth	—	3,377 (3.7%)	4,831 (5.1%)	4,857 (4.9%)	6,048 (5.8%)	8,852 (8.0%)	8,086 (6.8%)	6,481 (5.1%)	—
State of Utah annual growth	—	2.13%	1.95%	1.56%	2.43%	3.05%	2.97%	2.55%	—

Source: U.S. Census Bureau 2008

[a] All estimates are for July 1 of the indicated year.

The Governor's Office of Planning and Budget recently released new population projections. These updated projections, which are shown in Table 2-7, summarize the most recent (2008) population projections for Washington County. As shown in the table, growth is expected to slow. However, the anticipated growth rate of Washington County is still expected to far exceed that of Utah as a whole between now and 2035.

Table 2-7. Population Projections for Washington County (2010–2035)

Parameter	Projection by Year[a]						2010–2035 Change
	2010	2015	2020	2025	2030	2035	
Population	168,078	219,324	279,864	346,408	415,510	486,315	318,237
Five-year change	—	51,246 (30.5%)	60,540 (27.6%)	66,544 (23.8%)	69,102 (19.9%)	70,805 (17.0%)	—
Washington County annual growth[b]	—	6.1%	5.5%	4.6%	3.4%	3.4%	—
State of Utah annual growth[b]	—	2.5%	2.2%	2.0%	1.8%	1.8%	—

Source: Governor's Office of Planning and Budget 2008a

[a] All population projections are for July 1 of the indicated year.

[b] Unweighted; this is the 5-year rate divided by 5.

The Governor's Office of Planning and Budget also released population growth estimates for individual cities and towns along the study corridors in May 2008 (see Table 2-8). According to city and county representatives, some of the growth projections are very inaccurate and do not show a realistic distribution across the various cities (HDR 2008).

Table 2-8. City and Town Population Projections (2010–2040)

City or Town	2010	2020		2030		2040	
	Population[a]	Population[a]	10-Year Change	Population[a]	10-Year Change	Population[a]	10-Year Change
Apple Valley	826	1,371	66%	2,036	49%	2,742	35%
Hildale	2,430	4,058	67%	6,008	48%	8,092	35%
Hurricane	16,381	27,287	67%	40,512	49%	54,568	35%
La Verkin	5,162	8,592	66%	12,756	49%	17,182	35%
Rockville	319	532	67%	789	48%	1,063	35%
Springdale	687	924	35%	1,163	26%	1,399	20%
Toquerville	1,514	2,519	66%	3,742	49%	5,040	35%
Virgin	634	1,063	68%	1,566	47%	2,109	35%

Source: Governor's Office of Planning and Budget 2008b

[a] All population projections are for July 1 of the indicated year.

Employment

The most recent employment summary from the Governor's Office of Planning and Budget estimates that there were 81,040 jobs in Washington County in January 2008. By 2035, the Governor's Office projects that the total number of jobs available will be 251,731. As shown in Table 2-9, the current employment opportunities are greatest in the Trade, Transportation, and Utilities industry. In 2035, the Trade, Transportation, and Utilities industry is expected to remain dominant but will be surpassed by employment in the Education and Health Services industry. The Construction industry is expected to remain strong through 2035.

Table 2-9. Washington County Employment (2008 and 2035)

Industry	2008	2035
Natural Resources and Mining	727	634
Construction	10,864	31,623
Manufacturing	3356	8,737
Trade, Transportation, and Utilities	17,000	39,215
Information	1,308	3,258
Financial Activity	7,723	22,820
Professional and Business Services	7,787	25,556
Education and Health Services	10,233	49,843
Leisure and Hospitality	9,345	29,268
Other Services	4,666	14,012
Government	8,031	26,765
Total employment	81,040	251,731

Source: Governor's Office of Planning and Budget 2008c

2.2 Roadway Characteristics

Even though the study highways are geographically close, each serves a distinct purpose. SR-9 provides the primary access to Zion National Park, while SR-17 is a primary connector between I-15 and SR-59. SR-59 is an important connector to Arizona and beyond that provides a main route for the movement of goods between Washington County and northern Arizona. UDOT manages the day-to-day operation and maintenance of the corridors through its maintenance station in Hurricane (Station 4522). Day-to-day activities performed through the maintenance station include removing snow, leveling lanes, sealing cracks, maintaining shoulders and drainage systems, cleaning up hazardous spills, and

repairing road and structure damage. The work overseen through the maintenance station is critical to the safe operation of all three highways.

Planning for projects that go beyond maintenance starts at the UDOT Region 4 office in Richfield. Region 4 project managers identify, plan, and oversee completion of larger projects such as highway widening. Region 4 staff members also work with staff from the UDOT headquarters to identify projects and project funding options.

A basic understanding of the current conditions of the highways is necessary in order to determine what types of future projects are needed along the highways. This section describes the existing highway geometrics, structural conditions, traffic conditions, and bicycle and pedestrian facilities of the three study corridors and reviews the transportation plans that apply to the study corridors. Potential solutions to issues or problem areas identified in this section are addressed in Section 5.0, Project Identification and Recommendations, which begins on page 75 of this report.

2.2.1 SR-9 Conditions

Highway Geometrics

Terrain

Terrain type is a factor that greatly affects roadway conditions and ultimately how roads operate. Roadway terrain is typically described as *level*, *rolling*, or *mountainous*. On level terrain, all types of vehicles can generally maintain the same speeds. On rolling terrain, the speeds of heavy vehicles (such as heavy trucks) can be substantially slower than those of passenger vehicles, but are not so slow that heavy vehicles have to operate at "crawl" speeds for long periods. Mountainous terrain causes heavy vehicles to operate at crawl speeds for significant distances or frequent intervals (TRB 2000).

Other than the 2.5 miles from the SR-9/SR-17 junction in La Verkin (MP 12.5) to the La Verkin Overlook Road (MP 15), which is a relatively steep (5% to 6%) grade, the terrain of SR-9 is generally level. Though there are some segments that could be considered rolling terrain, these segments are short enough that they do not significantly affect the operation of the highway for any extended period.

Horizontal and Vertical Alignment

Roadway alignment is the path that a roadway's centerline follows. Alignment is described in terms of horizontal and vertical planes. The combination of horizontal and vertical alignments is the primary element that controls the design

of public streets and highways. Alignment affects roadway capacity, safety, and function.

As mentioned above in the section titled Terrain, the 2.5 miles of SR-9 from its intersection with SR-17 to La Verkin Overlook Road is a steep grade. Combined with the steep grade, a few sharper horizontal curves restrict the speed limit to about 45 mph through this segment as the road climbs up the side of the hill. Once on top, the alignment straightens out for about 10 miles to the town of Rockville with more gradual horizontal and vertical curves that follow the natural features of the terrain.

From Rockville through the town of Springdale, the alignment of SR-9 becomes narrower as the road enters Zion National Park and winds its way through the more rugged terrain. The horizontal curves become sharper, and the speed limit is reduced.

Passing Opportunities

The length of SR-9 from La Verkin to Springdale, coupled with the large amount of slower recreational vehicles and out-of-area tourists, result in many drivers looking for opportunities to pass along this two-lane road. However, the combination of the horizontal and vertical alignment, the spacing of the towns, and the number of access points limit safe passing opportunities. Most of the passing zones are not very long, and the passing sight distance is limited. Motorists must also be aware of bicyclists on the shoulders and the numerous access and driveway locations along the route that can interfere with passing opportunities.

The segment of SR-9 between Virgin and Rockville has a larger-than-expected number of head-on and passing-related crashes. This suggests that motorists often want to pass in this area but there are not enough safe passing opportunities. As a result, motorists are taking unsafe risks in their attempts to pass.

Right-of-Way Width

The right-of-way width of SR-9 varies along its length between La Verkin and Springdale. In some areas, such as through the center of Rockville and Springdale, it is as narrow as 66 feet. In other areas, such as the open areas between Virgin and Rockville, it is as wide as 450 feet.

Table 2-10 shows the average right-of-way width by segment. The mileposts and right-of-way widths shown in the table are approximate and are based on the best available information from UDOT.

Table 2-10. Average Right-of-Way Width by Segment of SR-9

Segment	Average Right-of-Way Width (feet)[a]
MP 12.5 to MP 13	80–100
MP 13 to MP 17	400
MP 17 to MP 19	80–120
MP 19 to MP 20	190–330
MP 20 to MP 20.5	450
MP 20.5 to MP 24	200–320
MP 24 to MP 26.5	100
MP 26.5 to MP 28	66–130
MP 28 to MP 30	133–200
MP 30 to MP 32.5	66–100

[a] Widths estimated from best available milepost and as-built roadway plans as provided by UDOT.

Lane and Shoulder Width

The travel lanes on SR-9 are generally the width recommended by the American Association of State Highway and Transportation Officials (AASHTO), which is 12 feet. This width accommodates the wide range of vehicle types and sizes that travel this route. Turning lanes range from 10 to 14 feet wide, which also corresponds with the lane widths recommended by AASHTO.

Shoulder widths along SR-9 vary from 2 to 5 feet. This is less than the AASHTO-recommended shoulder width for this type of facility, which is 8 to 12 feet.

Structural Conditions

Pavement Condition

UDOT determines pavement condition by using the skid number, IRI HCS (international roughness index half-car simulation, a measure of ride condition), and rut depth. The classification for each of the values is directly related to corresponding range for that number. These ranges are shown in Table 2-11.

Table 2-11. Pavement Ratings and Ranges

Rating Type	Classification
Skid Number (SN)	
SN > 45	Standard
30 > SN > 45	Marginal
SN < 30	Substandard
IRI HCS	
IRI < 45	Very Good
45 < IRI < 70	Good
70 < IRI < 100	Fair
100 < IRI < 135	Poor
IRI >135	Very Poor
Rut Depth (inches)	
R < 0.1	Very Good
0.1 < R < 0.25	Good
0.25 < R < 0.50	Fair
0.50 < R < 0.75	Poor
R > 0.75	Very Poor

Source: UDOT 2001

The IRI HCS ratings for SR-9 are primarily fair and poor along the length of SR-9 in the study area with the exception of a segment between about MP 24 and MP 25, which is classified as "good" (UDOT 2008a). Table 2-12 shows the 2005 skid number and 2005 rut depth measurements for SR-9 by milepost. These measurements generally indicate good conditions along the highway, though the rut depths between about MP 28 and MP 32 indicate fair pavement condition. Deeper rutting through Springdale was reported by local residents; UDOT's data are consistent with that information.

Table 2-12. Skid Numbers and Rut Depths on SR-9

	Pavement Condition	
Milepost	Skid Number	Rut Depth
11	61	0.12
12	38	0.15
13	46	0.14
14	50	0.15
15	51	0.13
16	53	0.10
17	54	0.13
18	48	0.11
19	54	0.17
20	54	0.11
21	53	0.08
22	58	0.07
23	55	0.13
24	53	0.12
25	53	0.08
26	53	0.13
27	53	0.19
28	65	0.26
29	67	0.23
30	62	0.27
31	61	0.32
32	58	0.26

Sources: UDOT 2007b, 2007c

Drainage

Drainage along SR-9 is sheet flow off the highway into roadside ditches and is handled through cross culverts spaced periodically along the highway to convey water into the natural drainage paths. There are no specific storm drain systems or retention/detention basins along this section of SR-9.

Through the towns of Rockville and Springdale, there are areas of open-channel rock ditches adjacent to the pavement. Driveways and other access points through these areas cross over the rock ditches. The ditches carry both runoff and irrigation flows. Because they do not have curbs or other barriers separating them from the roadway, the open ditches are a safety hazard to all types of roadway users. According to Rockville Town representatives, the existing ditch and culvert system cannot accommodate runoff during very large storms (HDR 2008).

Bridge and Structure Conditions

Bridge sufficiency ratings are used to determine whether a bridge is eligible for bridge replacement and rehabilitation and can indicate the relative condition of a structure. The ratings are based on structural adequacy, compliance with current design standards, importance for public use, and eligibility for federal bridge-replacement funds. Ratings below 50 indicate that the structure should be replaced. Ratings between 50 and 80 indicate that the structure is in fair condition and that rehabilitation, if cost-effective, should be considered. Structures with ratings of 80 or higher are in good or very good condition and are not eligible for federal funding through the Highway Bridge Rehabilitation and Replacement (HBRR) Program.

There are five bridges along SR-9 in the study limits. As shown in Table 2-13, three of the bridges are rated as fair. The other two bridges are in good condition.

Table 2-13. Bridges along SR-9

Bridge Identification Number	Milepost	Sufficiency Rating	Water Feature Intersected	Bridge Type
0E 426	14.8	68.5	Dry Wash	Concrete continuous
0F 468	19.3	80	North Creek	Prestressed concrete
0F 485	25.3	80	Coal Pit Wash	Prestressed concrete
0F 82	31.5	55.2	Springdale Wash	Concrete
0E1328	32.2	75	Black Canyon Wash	Concrete

Source: UDOT 2008b

In addition to bridges, there are also a number of culverts along SR-9. In some cases, the culvert ends are very close to the road edge, which has the effect of narrowing the clear zone through those areas. This condition exists at about MP 13.1, MP 20.0, MP 20.5, MP 23.3, and MP 30.4.

Traffic Conditions

Level of Service

Horrocks Engineers evaluated the existing conditions of the EWCTS corridors. Horrocks specifically evaluated the Annual Average Daily Traffic (AADT), levels of service, truck percentages, and seasonal variations.

Horrocks based traffic level of service (LOS) calculations on the procedures in the Transportation Research Board *Highway Capacity Manual 2000* (TRB 2000). Level of service is a measure of the traveling conditions on a road, generally for aspects such as speed and travel time, freedom to maneuver, traffic interruptions, and comfort and convenience (TRB 2000). The Transportation Research Board defines the following six levels of service:

- A: Free flow of traffic
- B: Reasonably free flow
- C: Stable flow
- D: Approaching unstable flow
- E: Unstable flow
- F: Forced or breakdown flow

Level of service conditions for two-lane rural roads like SR-9 are typically calculated using roadway capacity and roadway demand. Specifically, level of service is defined by looking at the vehicles per day or vehicles per lane per hour and/or the percentage of time spent following other vehicles in queues and trying to pass slower-moving vehicles. Level of service is also affected by the number of lanes, terrain (such as rolling versus flat), shoulder and lane widths, access points per mile, and vehicle mix (such as percentage of heavy trucks). A level of service of E (LOS E) is generally considered to be the threshold when the roadway reaches full capacity. Table 2-14 and Figure 5 below show the existing (2006) traffic volumes and levels of service on representative segments of SR-9.

Table 2-14. Existing (2006) Levels of Service on SR-9

Begin MP	End MP	2006 AADT	Number of Lanes	2006 LOS
12.5	17.8	5,530	3	A
17.8	26.8	2,770	2	A
26.8	29.8	2,190	2	A
29.8	32.7	2,215	2	A

Source: Horrocks Engineers 2007

As shown in Table 2-14 above, current levels of service along SR-9 are free-flowing. The segments listed are in areas where the highway is two lanes (one lane in each direction). The information in Table 2-14 does not represent the level of service that would be experienced in areas where the highway is multiple lanes, has climbing or passing lanes, or travels through towns with intersections and multiple access points. Detailed analyses would be required to develop levels of service for these other areas. Because the purpose of the EWCTS is to develop a general idea of highway level of service, these additional analyses were not part of the study.

According to UDOT, in 2006, truck traffic on SR-9 made up about 9% of the daily traffic between about MP 11 and MP 18. East of about MP 18, the truck traffic made up about 17% of the total daily traffic stream. However, the vehicle classification data collected by UDOT do not readily distinguish between trucks and RVs. Due to the recreational and tourist nature of SR-9 and the fact that heavy trucks are not allowed through Zion National Park, it is generally assumed that these truck percentages consist mostly of larger recreational and tourist vehicles such as motorhomes, buses, and local delivery trucks and not heavy interstate or semi-tractor-trailer-type trucks.

Because it provides direct access to Zion National Park, SR-9 is a very tourist-oriented and recreation-oriented route. Traffic volumes on SR-9 vary greatly depending on the time of year. Traffic is only about 85% of the AADT during January when recreation and tourist activities associated with Zion National Park are low and temperatures are colder, but traffic is about 118% of the AADT during July and August when park visitation and recreation activities peak.

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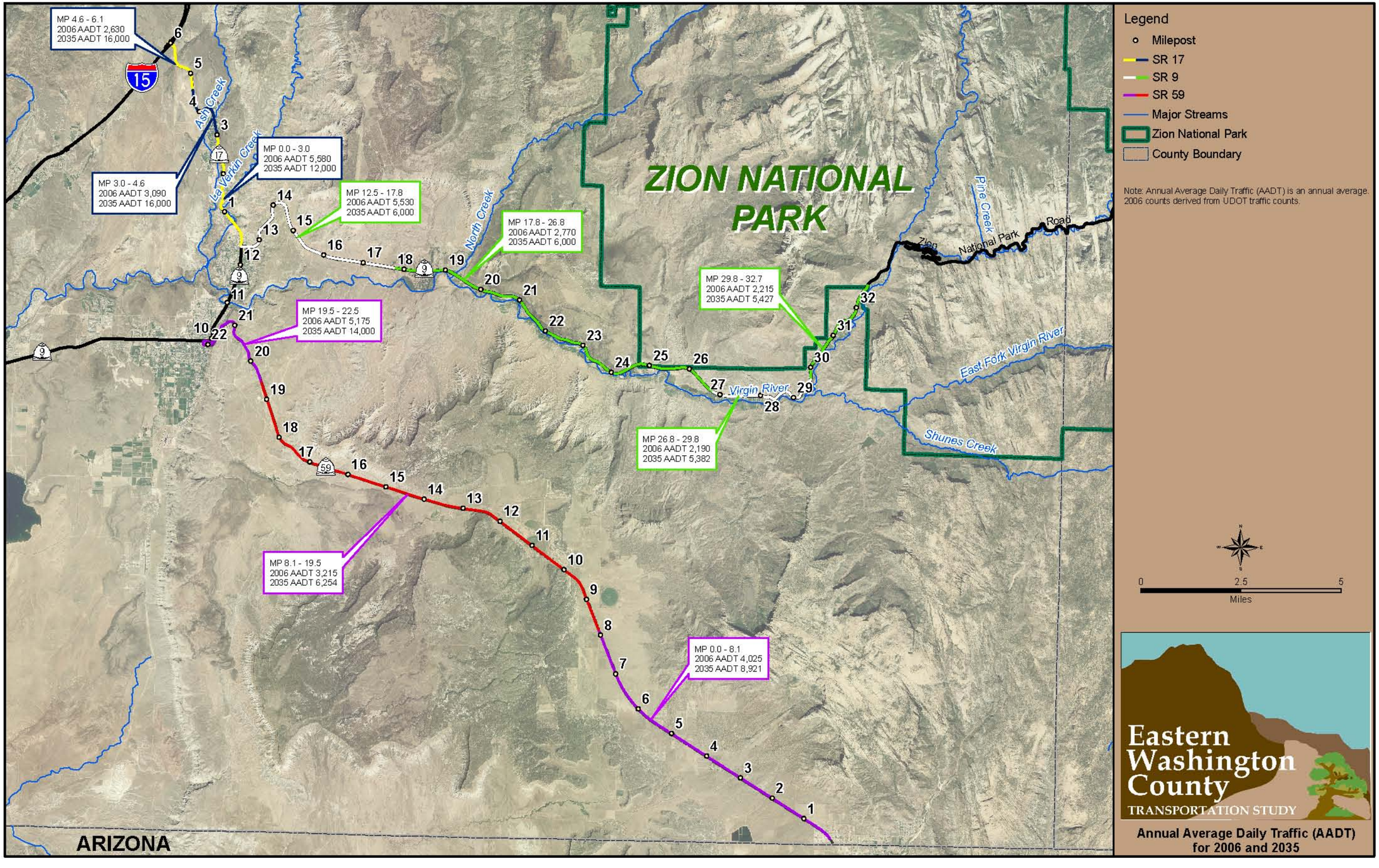
Figure 5. Annual Average Daily Traffic (AADT) for 2006 and 2035



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Access Management

Access standards and access management greatly affect the safety and operation of rural highways such as SR-9, especially where the highway intersects developed cities and towns. Table 2-15 lists UDOT's statewide access-management standards (Utah Administrative Code, Rule R930-6, Accommodation of Utilities and the Control and Protection of State Highway Rights-of-Way, January 2006). None of the corridors currently meet all of the standards shown in Table 2-15, especially along the more developed segments in cities and towns. This noncompliance is expected because these corridors were some of the first major thoroughfares in the area and have been in use for a very long time, much longer than the access-management standards have been in place. However, even though SR-9 and the other corridors might not currently meet UDOT's standards, the standards can be used to provide guidance as improvements are made and the corridors continue to develop.

Table 2-15. Access-Management Standards for State Highways

	Category	Minimum Signal Spacing (feet)	Minimum Street Spacing (feet)	Minimum Access Spacing (feet)	Minimum Interchange to Cross Road Access Spacing (feet)		
					Standard A: to 1st R-in R-out[a]	Standard B: to 1st Intersection[b]	Standard C: from Last R-in R-out[c]
1	Interstate/ Freeway	Freeway/Interstate Standards Apply					
2	System Priority Rural	5,280	1,000	1,000	1,320	1,320	1,320
3	System Priority Urban	2,640	No unsignalized access permitted		1,320	1,320	1,320
4	Regional Rural	2,640	660	500	660	1,320	500
5	Regional – Priority Urban	2,640	660	350	660	1,320	500
6	Regional Urban	1,320	350	200	500	1,320	500
7	Community Rural	1,320	300	150	NA	NA	NA
8	Community Urban	1,320	300	150	NA	NA	NA
9	Other	1,320	300	150	NA	NA	NA

Source: Utah Administrative Code, Rule R930-6

[a] Standard A refers to the distance from the interchange off ramp gore area to the first right-in/right-out driveway intersection.

[b] Standard B refers to the distance from the interchange off ramp gore area to the first major intersection.

[c] Standard C refers to the distance from the last right-in/right-out driveway intersection to the interchange on ramp gore area.

Table 2-16 summarizes the current access categories for SR-9 in the study area. UDOT expects that, as the corridor is improved and developed, the access management will be improved as well. Additionally, access categories are expected to change as the highway is modified and improved over time, which will also affect the standards that need to be implemented.

Table 2-16. Access-Management Categories for SR-9 in the Study Area

Begin MP	End MP	Category
7.9	12.7	Regional Priority Urban
12.7	17.8	System Priority Rural
17.8	18.9	Regional Rural
18.9	26.7	System Priority Rural
26.7	27.3	Regional Rural
27.3	32.7	Regional Urban

Source: UDOT 2006a

Safety

Horrocks Engineers completed a safety audit of SR-9 in February 2008 (Horrocks Engineers 2008). The following recommendations are based on general observations of the highway.

- The crash *frequency* on SR-9 is less than expected, but the crash *severity* is considerably higher than expected compared to similar roads in Utah.
- Newer-style rumble strips are not present along much of SR-9. Shoulders along SR-9 are about 2 to 5 feet wide. New standard rumble strips should be added.
- Passing sight distance is a concern in areas where passing is permitted between Virgin and Rockville (about MP 18 through about MP 27); the terrain and geometry of the roadway appear to prohibit safe passing. The crash history shows a large number of head-on and passing-related collisions in this area. The ideal solution would be to have a four-lane roadway between Virgin and Rockville (from about MP 18 to about MP 27).
- Raised pavement markers would help delineate the roadway for the last 6 miles where there is winding road geometry.
- There have been many crashes reported between MP 27 and MP 33, where the road geometry has sharp horizontal and vertical curves combined with numerous access points. It is likely that vehicles are traveling too fast for the conditions and that drivers are not aware of the geometry.

The crash history for SR-9 shows 114 crashes for 2002 to 2005, or an average of 28.5 crashes per year. The average accident rate on the highway is 0.75 accidents per million vehicle-miles traveled, which is less than the expected value of 1.46 (the *expected value* is what is expected for similar types of roads in Utah). The severity index is an average of 2.00, which is higher than the expected index value of 1.70.

The most frequent accident type over the 4-year period was single-vehicle collisions; 60 (53%) of the crashes involved only a single vehicle. The second-most-frequent accident type was rear-end collisions, which consisted of 14 crashes (12%). The other crashes varied among 14 other accident types.

From 2002 to 2005, 25 crashes were run-off-the-road crashes and 17 involved vehicles hitting animals.

The distribution of accident severity over the 4-year period was as follows:

- Non-injury: 61
- Possible injury: 15
- Injury: 14
- Incapacitating injury: 23
- Fatal: 1

Bicycle and Pedestrian Facilities

SR-9 from La Verkin to Springdale is a popular route for recreational bicycling even though it does not have formal bicycle lanes or bikeways. Residents of the towns along this part of SR-9 also ride within town and between towns along the highway. The part of SR-9 that passes through Hurricane and La Verkin has sections of sidewalk available for pedestrian use, but the sidewalk is not continuous. In La Verkin, children often ride their bicycles on the sidewalk.

According to the Utah Bicycle Suitability Map (UDOT 2004a), the shoulder of SR-9 is between 2 and 4 feet wide from the intersection with SR-59 to just east of the intersection with SR-17 (through the top of the "Twist"). East of this point, the shoulders are generally at least 4 feet wide except through Virgin and through Rockville and Springdale, where shoulders are often less than 2 feet wide. The City of Springdale and UDOT recently completed a feasibility study for construction of a bicycle and pedestrian trail between Springdale and Rockville, but construction of the trail is not fully funded. SR-9 does not have any special restrictions for bicycle use in the study area.

Because sidewalks are not present along most of SR-9, pedestrians often walk along the roadway shoulder. Pedestrians commonly use the shoulder in

Springdale due to the town's proximity to Zion National Park and facilities that cater to tourists. The bridge over the Virgin River in La Verkin has a pedestrian walkway on its east side but lacks a walkway on its west side. The City of La Verkin has noted safety problems with pedestrians' opportunities to cross SR-9 to safely access the eastern pedestrian walkway.

2.2.2 SR-17 Conditions

Highway Geometrics

Terrain

Through the town of La Verkin, the SR-17 terrain is level and representative of a standard municipal-type road that is generally flat. From La Verkin through the town of Toquerville to the junction of I-15, the road passes through a combination of level and rolling terrain. Just north of Toquerville, there is a segment that has steeper grades, though most grades along the corridor are not steep or long enough to be considered mountainous terrain.

Horizontal and Vertical Alignment

Through the town of La Verkin, the alignment of SR-17 is generally straight and flat with very little variation in horizontal or vertical alignment. Between La Verkin and Toquerville, the alignment has more horizontal and vertical curvature as the road bends around hillsides and roadside features and crosses over the La Verkin Creek. Some of these horizontal curves are sharp enough to warrant a sign that warns of a reduced-speed curve. The segment between Toquerville and I-15 has the most vertical changes in elevation as the road climbs over a steeper ridgeline. There are also a few sharper horizontal curves in this area.

Passing Opportunities

There are few passing opportunities along SR-17. Because the segments through the towns do not allow passing, only short segments between La Verkin and Toquerville and between Toquerville and I-15 allow passing. However, the combination of horizontal and vertical alignments in these segments makes passing difficult and risky, especially during peak travel periods. For these reasons, vehicles do not pass often on SR-17.

Right-of-Way Width

UDOT's available right-of-way information for SR-17 is limited. However, this limited information indicates that most of the SR-17 right-of-way between SR-9 and I-15 is between 66 and 90 feet wide. A few areas have a right-of-way as narrow as 50 feet and as wide as 400 feet, but these areas are typically only a few hundred feet long.

Lane and Shoulder Width

The travel lanes on SR-17 are generally the AASHTO-recommended width of 12 feet. This width accommodates the wide range of vehicle types and sizes that travel this route. Turning lanes range from 10 to 14 feet wide, which also corresponds with the lane widths recommended by AASHTO.

Shoulder widths along SR-17 vary from 2 to 5 feet. This is less than the AASHTO-recommended shoulder width for this type of facility, which is 8 to 12 feet.

Structural Conditions

Pavement Condition

The IRI HCS ratings for SR-17 are fair along the entire length of SR-17 (UDOT 2008a). Table 2-17 shows the 2005 skid number and 2005 rut depth measurements for SR-17 by milepost. These measurements generally indicate good conditions along the highway with the exception of about MP 1, which showed substandard conditions based on skid number.

Table 2-17. Skid Numbers and Rut Depths on SR-17

	Pavement Condition	
Milepost	Skid Number	Rut Depth
1	30	0.14
2	50	0.16
3	46	0.15
4	38	0.17
5	59	0.15
6	52	0.23

Sources: UDOT 2007b, 2007c

Drainage

As with SR-9, drainage along SR-17 is sheet flow off the highway into roadside ditches that is handled through cross culverts spaced periodically along the highway to convey water into the natural drainage paths. For the most part, there are no specific storm drain systems or retention/detention basins. There is a limited storm drainage system with curb and gutter through sections of La Verkin, but this is the only area with this type of infrastructure.

During normal storms, the existing drainage system appears to function at acceptable levels with minimal flooding. However, it is unknown if the system is adequate to accommodate larger storms and floods. Based on the history of the development of the corridor, it is unlikely that the drainage system is adequate to accommodate a 100-year storm.

Bridge and Structure Conditions

There are two bridges on SR-17 in the study limits. As shown in Table 2-18, both bridges are in very good condition.

Table 2-18. Bridges along SR-17

Bridge Identification Number	Milepost	Sufficiency Rating	Water Feature Intersected	Bridge Type
0F 589	0.6	94.5	La Verkin Creek	Prestressed concrete
0F 550	3.4	96.9	Ash Creek	Prestressed concrete

Source: UDOT 2008b

Traffic Conditions

Level of Service

Table 2-19 and Figure 5 above, Annual Average Daily Traffic (AADT) for 2006 and 2035, show the existing (2006) levels of service on SR-17.

Table 2-19. Existing (2006) Levels of Service on SR-17

Begin MP	End MP	2006 AADT	Number of Lanes	2006 LOS
0.0	1.0	5,580	3	A
1.0	4.6	3,090	2	A
4.6	6.0	2,630	2	A

Source: Horrocks Engineers 2007

As shown in Table 2-19 above, current levels of service along SR-17 are free-flowing. As with SR-9, the information about SR-17 in Table 2-19 does not represent the level of service that would be experienced in areas where the highway is multiple lanes, has climbing or passing lanes, or travels through towns with intersections and multiple access points. Detailed analyses would be required to develop levels of service for these other areas. Because the purpose of the EWCTS is to develop a general idea of highway level of service, these additional analyses were not part of the study.

In 2006, truck traffic on SR-17 made up between 17% and 24% of the daily traffic along the 6-mile-long corridor. Truck traffic was lightest (17%) near the intersection of SR-17 and SR-9 and heaviest (24%) near the intersection with I-15. Truck percentages gradually increase from south to north between these two points.

Unlike SR-9, where the majority of UDOT's recorded truck traffic is large RVs and light delivery trucks, much of the truck traffic on SR-17 is heavy, semi-tractor-trailer-type trucks. SR-17 is a major interstate truck route that connects SR-59 (which carries traffic to and from northern Arizona) to I-15 and carries a significant amount of regional truck traffic.

Seasonal variation on SR-17 is similar to that on SR-9 (lower AADT in the winter and higher AADT in the summer) since SR-17 also provides an important connection to the entrance to Zion National Park. The seasonal variation on SR-17 is not as pronounced as that on SR-9 since SR-17 serves more local and commuter traffic that uses the route on a daily basis, regardless of the time of year.

Access Management

The entire length of SR-17 is currently designated Regional Rural for access-management purposes (UDOT 2006a). This category is described above in Table 2-15, Access-Management Standards for State Highways. As with SR-9, the corridor does not completely comply with the current state standards. However, as the corridor is improved and developed, the access management will be improved as well. Additionally, access categories are expected to change as the highway is modified and improved over time, which will also affect compliance with the standards.

Safety

Horrocks Engineers completed a safety audit of SR-17 in February 2008 (Horrocks 2008). In its report, Horrocks noted that narrow shoulders exist all along SR-17 and that rumble strips should be installed along the entire corridor.

Overall, the crash *frequency* on SR-17 is higher than expected, and the crash *severity* is considerably higher than expected compared to similar roads in Utah. The crash history for SR-17 shows 40 crashes for the period 2002 to 2005, which is an average of 10 crashes per year. The average accident rate is 1.50 accidents per million vehicle-miles traveled, which is slightly higher than the expected value of 1.46. The severity index is an average of 2.10, which is higher than the expected index of 1.70. The average crash rate is significantly affected by the 2003 rate, which was 2.86. The years 2002, 2004, and 2005 all have a crash rate of about 1.05.

The most frequent accident type over the 4-year period was single vehicle collisions; 30 (75%) of the crashes involved only a single vehicle. The other crashes varied among six other accident types.

From 2002 to 2005, 17 crashes were run-off-the-road crashes and six involved vehicles hitting animals.

The distribution of accident severity over the 4-year period was as follows:

- Non-injury: 18
- Possible injury: 10
- Injury: 6
- Incapacitating injury: 5
- Fatal: 1

Pedestrian and Bicycle Facilities

SR-17 is not as popular a route for recreational bicycling as SR-9. Like SR-9, it does not have formal bicycle lanes or bikeways. Residents of the towns along this part of SR-17 ride within town and from town to town along the highway. The part of SR-17 that passes through La Verkin has sections of sidewalk available for pedestrian use, but the sidewalk is not continuous. In La Verkin, children often ride their bicycles on the sidewalk.

According to the Utah Bicycle Suitability Map (UDOT 2004a), the shoulder of SR-17 is between 2 and 5 feet. SR-17 does not have any special restrictions for bicycle use in the study area.

Because there are no sidewalks along most of SR-17, pedestrians often walk along the road shoulder or on the road itself, a situation that city representatives believe is too dangerous. This is of particular concern to the City because most pedestrians are school-age children that walk to and from bus stops in La Verkin and Toquerville (HDR 2008).

2.2.3 SR-59 Conditions

Highway Geometrics

Terrain

Other than the final 3 miles down the "Hurricane Hill" into Hurricane, which is a very steep grade (6% to 8% in some places), the terrain of SR-59 is generally level. Though some segments could be considered rolling terrain, they are short enough that they do not significantly affect operation of the highway for any extended period.

Horizontal and Vertical Alignment

As mentioned above in the section titled Terrain, the last 3 miles of SR-59 that travel down the "Hurricane Hill" are on a steep grade. Just south of MP 21, there is a runaway truck ramp due to the severity of the grade. Though this might not be the optimal location for the ramp based on truck operations and speeds, it is the only location along this part of SR-59 with enough available space to accommodate a runaway truck ramp. The ramp appears to function adequately and is used on a regular basis. Combined with the steep grade, there are a few sharper horizontal curves that restrict the speed limit to about 35 mph through this segment as the road traverses the side of the hill. From the Arizona state line (MP 0) to the "Hurricane Hill," the alignment is generally straight with gradual horizontal and vertical curves that follow the natural features of the terrain.

Passing Opportunities

From the Arizona state line (MP 0) through the town of Hildale (about MP 1), there are no passing opportunities due to numerous intersections, access points, and driveways in town. The section of highway between MP 1 and about MP 20 provides more opportunities for passing since there are several longer, straight segments. However, additional designated passing lanes would increase the safety for passing maneuvers. The numerous trucks that use this route often interfere with the ability to pass safely.

Right-of-Way Width

The right-of-way width of SR-59 is generally between 100 and 200 feet. An exception is the last (northernmost) two blocks in downtown Hurricane along 100 South and Main Street where SR-59 ties to SR-9; the right-of-way through this area is 200 feet wide.

Table 2-20 shows the average right-of-way width by segment. The mileposts and right-of-way widths shown in the table are only approximate based on the best available information from UDOT.

Table 2-20. Average Right-of-Way Width by Segment of SR-59

Segment	Average Right-of-Way Width (feet)[a]
MP 0 to MP 15	100
MP 15 to MP 23	200

[a] Widths determined from best available milepost and as-built roadway plans as provided by UDOT.

Lane and Shoulder Width

The travel lanes on SR-59 are generally the AASHTO-recommended width of 12 feet. This width accommodates the wide range of vehicle types and sizes that travel this route. Turning lanes range from 10 to 14 feet wide, which also corresponds with the lane widths recommended by AASHTO.

Shoulder widths along SR-59 vary from 2 to 5 feet. This is less than the AASHTO-recommended shoulder width for this type of facility, which is 8 to 12 feet.

Structural Conditions

Pavement Condition

The IRI HCS ratings for SR-59 are fair and poor along the entire length of the highway (UDOT 2008a). Table 2-21 below shows the 2005 skid number and 2005 rut depth measurements for SR-59 by milepost. These measurements generally indicate good conditions along the highway.

Table 2-21. Skid Numbers and Rut Depths on SR-59

	Pavement Condition	
Milepost	Skid Number	Rut Depth
1	45	0.16
2	49	0.13
3	53	0.12
4	56	0.18
5	56	0.19
6	57	0.18
7	56	0.22
8	54	0.19
9	52	0.25
10	48	0.22
11	57	0.36
12	55	0.08
13	62	0.16
14	59	0.09
15	56	0.06
16	58	0.10
17	54	0.14
18	51	0.08
19	50	0.14
20	48	0.13
21	39	0.08
22	38	0.12

Sources: UDOT 2007b, 2007c

Drainage

Sheet flow drainage from SR-59 is handled through roadside ditches with cross culverts spaced periodically along the highway to convey water into the natural drainage paths through the area. There are no specific storm drain systems or retention/detention basins along SR-59.

Bridge and Structure Conditions

There are two bridges on SR-59 in the study limits. As shown in Table 2-22 below, both bridges are in good condition.

Table 2-22. Bridges along SR-59

Bridge Identification Number	Milepost	Sufficiency Rating	Water Feature Intersected	Bridge Type
0H9862	9.2	80	Gould's Wash	Steel
0E2052	12.7	89.2	Gould's Wash	Concrete continuous

Source: UDOT 2008b

In addition to bridges, there are also a number of culverts along SR-59. As with SR-9, some of the culvert ends are very close to the road edge, which has the effect of narrowing the clear zone through those areas. This condition exists at about MP 1.3, MP 1.9, MP 11.1, MP 14.5, and MP 15.4.

Traffic Conditions

Level of Service

Table 2-23 and Figure 5 above, Annual Average Daily Traffic (AADT) for 2006 and 2035, show the existing (2006) levels of service on SR-59.

Table 2-23. Existing (2006) Levels of Service on SR-59

Begin MP	End MP	2006 AADT	Number of Lanes	2006 LOS
0.0	8.1	4,025	2	C
8.1	19.5	3,215	2	C
19.5	22.5	5,175	2	C

Source: Horrocks Engineers 2007

As shown in Table 2-23 above, current levels of service on SR-59 are generally stable flow. The segments listed are in areas where the highway is two lanes (one lane in each direction). The capacity thresholds for SR-59 are lower than those for SR-9 and SR-17 because the highway is used more for longer, higher-speed travel. On this type of highway, driver tolerance for slower speeds is lower and passing opportunities are fewer than for shorter, slower-speed highways (such as SR-9 and SR-17). Because of this difference, the level of service on SR-59 is lower even though the traffic volumes are similar to those on SR-9 and SR-17.

In 2006, truck traffic on SR-59 was about 17% of the total daily traffic near the Utah-Arizona border and 31% of the total daily traffic near the intersection with SR-9. The percentage of truck traffic on the highway near and through Apple Valley is about 24% of the total traffic stream.

SR-59 is an important regional and interstate truck route that connects northern and central Arizona to I-15. For this reason, many heavy interstate-type semi-tractor trailers use this route for long-haul trucking. This is reflected in the higher truck percentages recorded on SR-59. Also, many RVs use this route to access Zion National Park and the Glen Canyon National Recreation Area.

Seasonal variation on SR-59 is probably similar to that on SR-9 and SR-17 (lower AADT in the winter and higher AADT in the summer) since SR-59 is used by many travelers to access national parks and other recreation areas in northern Arizona.

Access Management

Table 2-24 summarizes the current access categories for SR-59 in the study area. Categories are described above in Table 2-15, Access-Management Standards for State Highways. As with the other corridors, SR-59 does not completely meet the current standards. However, as the corridor is improved and developed, the access management will be improved as well. Additionally, access categories are expected to change as the highway is modified and improved over time, which will also affect compliance with the standards.

Table 2-24. Access-Management Categories for SR-59 in the Study Area

Begin MP	End MP	Category
0.0	0.7	Regional Rural
0.7	19.5	System Priority Rural
19.5	20.7	Regional Rural
20.7	22.2	Community Rural

Source: Horrocks Engineers 2007

Safety

Horrocks Engineers completed a safety audit of SR-59 in February 2008 (Horrocks Engineers 2008). The following recommendations are based on general observations of the highway.

- The crash *frequency* and *severity* are higher than expected compared to similar roads in Utah.
- There are no rumble strips along the highway. The roadway has long, straight sections. Shoulders need to be widened along the entire segment and rumble strips added.
- Much of the existing guardrail between about MP 20 and MP 22 is in good condition. There are no signs of hits, but support behind posts is lacking and needs to be added (that is, additional fill material needs to be added to provide enough material to properly embed the posts and for lateral support).
- A dynamic speed feedback sign is needed for northbound traffic on the final descent (through the cliff) before the highway enters Hurricane.
- Many of the signs along the route are in poor condition with low reflectivity. Many signs have been shot up or are otherwise damaged. Signs need to be inventoried and replaced as appropriate.

The crash history for SR-59 shows 133 crashes for the period 2002 to 2005, which is an average of 33.3 crashes per year. The average accident rate is 1.76, which is higher than the expected value of 1.70. The severity index is an average of 1.52, which is more than the expected index of 1.46.

The most frequent accident type over the 4-year period was single-vehicle collisions; 82 (62%) of the crashes involved only a single vehicle. The other crashes varied among 16 other accident types.

From 2002 to 2005, 69 crashes were run-off-the-road crashes and six involved vehicles hitting animals.

The distribution of accident severity over the 4-year period was as follows:

- Non-injury: 84
- Possible injury: 19
- Injury: 14
- Incapacitating injury: 13
- Fatal: 3

Bicycle and Pedestrian Facilities

Several popular mountain-biking areas on BLM-administered land are accessed primarily by SR-59. Because most of these areas are far from the highway, there is not much related recreational bicycling along the highway. An exception is the area near the top of the Hurricane Cliffs, where mountain bikers sometimes use a short section of the highway to complete a mostly off-road loop. As with SR-9 and SR-17, SR-59 does not have formal bicycle lanes or bikeways. Some recreational road cyclists, such as those on long road tours, use SR-59 between the Utah-Arizona border and Hurricane. In Hildale, children often ride their bicycles along the side of the road.

There are no sidewalks along most of SR-59, the exception being short segments in Hurricane near the Hurricane City Center. The few pedestrians in and around the towns of Hildale and Apple Valley walk along short stretches of the road shoulder in areas near existing development because there is no other place for them to walk parallel to the highway.

2.3 Transportation Plans That Apply to the Study Area

There are few formal or adopted transportation plans that apply to the corridor study areas. Because the study area is outside the St. George metropolitan area, the Dixie Metropolitan Planning Organization's regional transportation plan does not address the study area. However, UDOT formerly worked with the cities of Hurricane, La Verkin, and Springdale to develop community transportation plans and with Springdale to develop a trail feasibility study. Apple Valley has developed a conceptual road plan. Finally, UDOT has also addressed some long-range planning goals for the highways through the Statewide Transportation Improvement Program (STIP) and its Long-Range Transportation Plan.

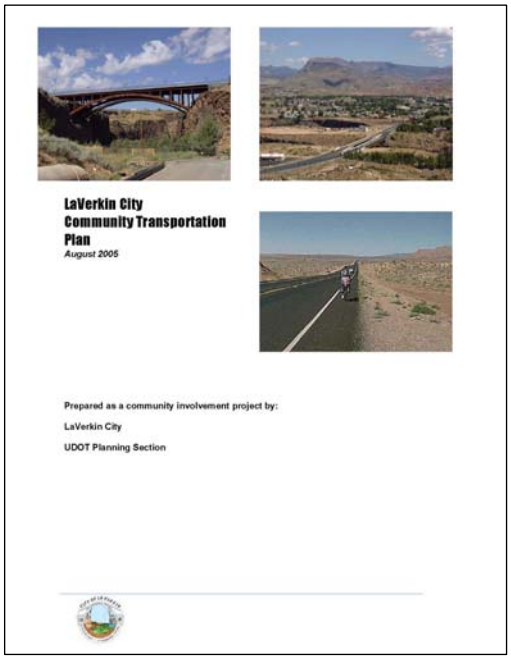
2.3.1 Hurricane City Transportation Master Plan

In 2004, UDOT and the City of Hurricane jointly prepared a Transportation Master Plan for the city (UDOT 2004b). A report that was released in October 2004 lists the priority improvements identified at that time. Hurricane has grown and changed substantially since that plan was prepared, but priority improvements that have not yet been constructed are probably still important to the city. The priority improvements listed in the transportation master plan and that occur in the EWCTS area are:

- 600 North: make improvements and construct new roadway from SR-9 to 2200 West
- Intersection of SR-59 and SR-9: realign SR-59 to intersect SR-9 at 600 North
- SR-9: widen SR-9 from 300 West to 600 North

2.3.2 La Verkin City Community Transportation Plan and General Plan

La Verkin City has a Community Transportation Plan that was completed in 2005 and includes transportation policies in its 2005 General Plan.



UDOT and the City of La Verkin jointly prepared La Verkin's Community Transportation Plan (UDOT 2005). A meeting with La Verkin staff in 2008 confirmed that some of the priority projects listed in the study have already been constructed, but others have not. The City has stated that the following priority projects listed in the 2005 plan are still needed:

- Add landscaping along SR-9
- Finish sidewalk improvements (much of the sidewalk improvements have been completed, but the area on SR-17 north of about 630 North is still in need of safe pedestrian facilities)
- Conduct speed review on SR-9 through the city
- Open the tunnel to Sand Traps as recreational trail
- Study and provide an alternate route for vehicle traffic, possibly Hot Springs Bridge (also known as the Pah Tempe Bridge)

The City has also recently identified some additional priority projects along the SR-9 and SR-17 corridors (HDR 2008). These projects are:

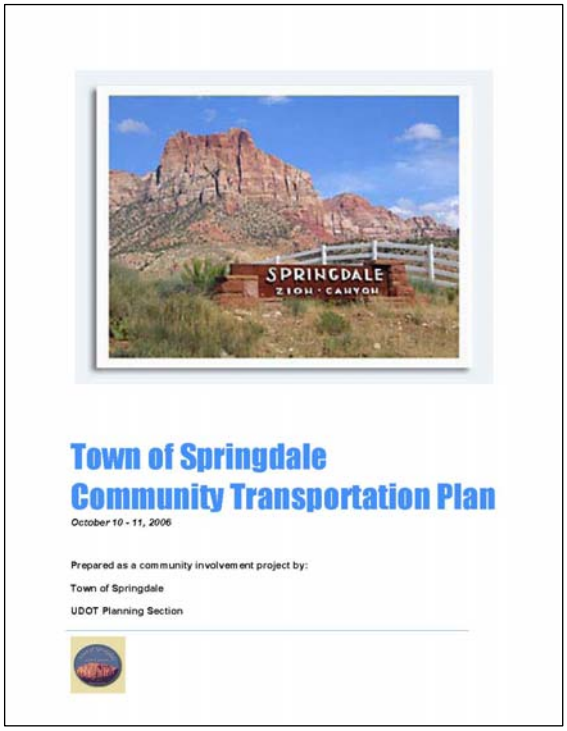
- Additional pedestrian walkway on the west side of the Virgin River Bridge
- Left-turn lane for westbound traffic just east of the SR-9/SR-17 intersection
- Power backup for the stoplight at the intersection of SR-9 and SR-17

The La Verkin City General Plan (Utah Community Planners 2005) includes the following transportation policies that are directly related to management of UDOT facilities in the city:

- Cooperate with UDOT to provide appropriate traffic-control devices or signs where needed.
- Participate in intergovernmental coordination and cooperation among all agencies and levels of government for planning, management, financing, and implementation of transportation system improvements.
- Protect SR-9 and SR-17 by encouraging site designs that minimize the number and frequency of curb and median cuts necessary to serve proposed developments along the highways.

2.3.3 Springdale Town Community Transportation Plan, General Plan, and Trail Feasibility Study

The Town of Springdale has a Community Transportation Plan and includes transportation policies in its General Plan. The Town also recently worked with UDOT to complete a feasibility study for a Zion Canyon Trail that would parallel SR-9.



UDOT and the Town of Springdale completed the Community Transportation Plan in October 2006 (UDOT 2006b). The priority projects listed in that plan are:

- Bridge and road realignment of the Paradise Road/SR-9 intersection
- Sidewalk projects
- Shielded lighting along SR-9
- Speed study to lower the speed limit
- New parking areas for Zion National Park visitors
- Zion Canyon bicycle/pedestrian trail

The Springdale Town General Plan (Town of Springdale 2005) includes objectives and implementation strategies that identify UDOT as a participant. The Town's objectives for SR-9 are as follows:

- Encourage a safe and well-maintained SR-9 corridor as well as other public streets throughout Springdale.
- Preserve the SR-9 corridor by ensuring that new development does not require widening of SR-9, except for a bicycle lane.
- Preserve slow speeds for traffic through Springdale.
- Maintain visibility at intersections, side streets, and driveways for safety.
- Reduce parking congestion through the use of creative approaches to meet the anticipated parking demand.
- Ensure that motorized traffic flows as smoothly as possible, despite anticipated large increases in traffic volume.

Recent discussions with Springdale Town staff have revealed that the Town is also interested in developing a corridor management agreement with UDOT to address long-term planning for design of development and access along SR-9. This corridor management agreement could address the recommended alignment for the proposed Zion Canyon Trail as described in the *Zion Canyon Trail Feasibility Study* (UDOT, no date).

2.3.4 Toquerville City Transportation Master Plan

A Transportation Master Plan was completed for the City of Toquerville in January 2008 (Riley Transportation Consultants and Sunrise Engineering 2008). The plan, which focuses on coordination with surrounding communities and the county, design issues and constraints, and right-of-way issues, provided direction for identifying the City's top transportation project priorities. In addition to reviewing existing data and projecting future conditions, the City worked with its residents to identify projects and develop the final plan. The plan development process included a detailed evaluation of SR-17 since it is the primary transportation facility through Toquerville.

Of highest priority to Toquerville is a bypass for SR-17. The plan identifies four different alignment options with alternatives for each alignment. The plan does not identify a preferred bypass alignment but does include action items to begin a more detailed SR-17 bypass study in coordination with UDOT and to work with the Dixie Metropolitan Planning Organization to identify funding for implementing the plan.

2.3.5 Apple Valley Road Plan

The Town of Apple Valley created a Road Plan in 2008 (Alpha Engineering Company 2008). That plan shows a major arterial intersecting SR-59 at about MP 8, which is the town's Main Street (also known as the Smithsonian Butte National Backcountry Byway). The Town identifies a major arterial as having a 100-foot-wide right-of-way. The Road Plan also shows 66-foot-wide major collectors intersecting SR-59 at about MP 2, MP 5, MP 6, MP 8 (critical intersection with the highway and the major arterial), and MP 12.5.

2.3.6 UDOT Plans: Statewide Transportation Improvement Program (STIP) and Long-Range Transportation Plan (LRTP)

The Statewide Transportation Improvement Program (UDOT 2008c) lists one major project along SR-9 that UDOT expects to finish constructing in 2008. This project involves the widening of SR-9 to four lanes between 300 West and 800 North in Hurricane. The Statewide Transportation Improvement Program does not list any other projects along the study corridors.

The Long-Range Transportation Plan (UDOT 2007d) identifies two major capacity improvement priorities for the study corridors. The first, to be constructed between 2026 and 2030, is widening SR-59 for about 1.6 miles between its intersection with SR-9 in Hurricane south through the cliff to about MP 20.5 (Big Plain Junction) on SR-59. The second project, which is identified only as "unfunded" and is not scheduled for a specific timeframe, is widening the entire length of SR-17 from La Verkin to its intersection with I-15.

2.3.7 Rural Planning Organization

In the summer of 2008, the cities of Hurricane, La Verkin, Leeds, and Toquerville officially became part of a new Rural Planning Organization (RPO). An RPO is an organization of elected officials from rural communities that provides a forum for local input on transportation issues that affect non-metropolitan areas with a population below 50,000. The RPO will serve as a link between UDOT, local elected officials, and citizens during the transportation planning and decision-making processes. The new RPO is managed by the Five County Association of Governments and is in the initial stages of developing a transportation plan. UDOT will be an important partner in the RPO's initial and subsequent transportation planning efforts.